



## Voluntary Carbon Standard Version 2007

### Monitoring Report

#### Monitoring Report:

|                                                                                                                                                                                                                                                                                                                       |                                                   |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------|
| <b>Work carried out by:</b>                                                                                                                                                                                                                                                                                           | <b>Date of the issue:</b>                         |
| Carbon Resource Management                                                                                                                                                                                                                                                                                            | 23/04/2009                                        |
| <b>Report Title:</b>                                                                                                                                                                                                                                                                                                  | <b>Reporting period:</b>                          |
| Pre-CDM monitoring report                                                                                                                                                                                                                                                                                             | 01/04/2006 to 05/12/2008                          |
| <b>Developer:</b>                                                                                                                                                                                                                                                                                                     | <b>Project Title:</b>                             |
| Tiefa Coal Industrial Group                                                                                                                                                                                                                                                                                           | Tiefa Coal Industry Group CMM Utilization Project |
| <b>Summary:</b>                                                                                                                                                                                                                                                                                                       |                                                   |
| <p>The purpose of this Monitoring Report for the Tiefa Coal Industry Group CMM Utilization Project is to calculate the emission reductions achieved by the project activity in the period covered by this report, and to serve as the basis for the verification of these reductions and issuance of VERs on VCS.</p> |                                                   |
| <b>Name of Verification company:</b>                                                                                                                                                                                                                                                                                  | <b>Number of pages:</b>                           |
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## 1 Introduction

### 1.1 Objective

The objective of this monitoring report is to calculate the emission reductions achieved by the project activity in the period covered by this report, and to serve as the basis for the verification of these reductions and issuance of the VCUs.

### 1.2 Verification Standard

VCS 2007

### 1.3 Document reference

Version: 2.0

Date: 23 April 2009

## 2 The Project

### 2.1 Title

Tiefa Coal Industry Group CMM Utilization Project

### 2.2 UNFCCC Reference

1880, registration date 6 December 2008.

### 2.3 Project Details

The proposed Tiefa CMM utilization project consists of three activities: (1) the capture of pre- and post-mining methane from six coal mines in the Tiefa mining area, (2) the blending of the two streams of methane to achieve a stable supply of methane of adequate concentrations, and, finally, (3) the supply of the methane to two gas supply companies who supply end users in the area.

This project had been registered and the registered PDD (version 3.1, dated 17/05/2008) is available on:  
<http://cdm.unfccc.int/UserManagement/FileStorage/HPLSJZDBYINTM4R87E02X5316VUGKF>

### 2.4 Baseline

#### 2.4.1 Methodology

The project participants use the approved methodology ACM0008 (version 3) "Consolidated methodology for coal bed methane and coal mine methane capture and use for power (electrical or motive) and heat and/or destruction by flaring" in the registered PDD.

Using this methodology, the emission reductions achieved by the project activity can be calculated primarily from the quantity of methane used and destroyed and the electricity consumption of the project activity and the emissions factor of the grid (calculated in the PDD using ACM0002 version 6).

### 2.4.2 Calculations

With no CBM<sup>1</sup> and NMHC concentrations less than 1% (see below), the emissions and emission reduction calculations are simplified to the following:

Project emissions are calculated with the formulae as follows, with values of factors fixed at the registered PDD, and with the further simplification that gas is only used in the gas grid:

$$PE_y = PE_{ME} + PE_{MD} + PE_{UM} \quad (1)$$

Where:

$PE_y$  is project emissions in year  $y$  (tCO<sub>2</sub>e)

$PE_{ME}$  is project emissions from energy use to capture and use methane (tCO<sub>2</sub>e)

$PE_{MD}$  is project emissions from methane destroyed (tCO<sub>2</sub>e)

$PE_{UM}$  is project emissions from un-combusted methane (tCO<sub>2</sub>e)

And:

$$PE_{ME} = CONS_{ELEC, PJ} \times CEF_{ELEC} \quad (2)$$

$$PE_{MD} = MM_{GAS} \times Eff_{GAS} \times CEF_{CH4} \quad (3 \text{ \& } 4)$$

$$PE_{UM} = \sum MM_i \times (1 - Eff_i) \times GWP_{CH4} \quad (5)$$

Where:

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<sup>1</sup> The project does not extract Coal Bed Methane, only Coal Mine Methane, i.e. directly linked to coal mining activity.

$CONS_{ELEC}$  is additional electricity consumption for capture and use of methane, if any (MWh)

$CEF_{ELEC}$  is CO<sub>2</sub> emission factor of electricity used by the project activity, calculated by the method specified in ACM0002 (1.0518 tCO<sub>2</sub>e/MWh)

$MM_{GAS}$  is methane supplied to gas grid (tCH<sub>4</sub>)

$Eff_{GAS}$  is overall efficiency of methane destruction/oxidation through gas grid to various combustion end users, combining fugitive emissions from the gas grid and combustion efficiency at end user (taken as 98.5%)

$CEF_{CH4}$  is carbon emission factor for combusted methane (2.75tCO<sub>2</sub>e/tCH<sub>4</sub>)

$MM_i$  is methane measured send to use  $i$  (tCH<sub>4</sub>)

$Eff_i$  is efficiency of methane destruction in use  $i$  (%) and set at 98.5%

$GWP_{CH4}$  is global warming potential of methane (21 tCO<sub>2</sub>e / tCH<sub>4</sub> of IPCC default value)

Similarly baseline emissions calculations are simplified to the following formulae:

$$BE_y = BE_{MD,y} + BE_{MR,y} \quad (6)$$

Where:

$BE_y$  is baseline emissions in year  $y$  (tCO<sub>2</sub>e)

$BE_{MD,y}$  is baseline emissions from destruction of methane in year  $y$  (tCO<sub>2</sub>e)

$BE_{MR,y}$  is baseline emissions from release of methane into the atmosphere in year  $y$  that is avoided by the project activity (tCO<sub>2</sub>e)

And:

$$BE_{MR,y} = GWP_{CH4} \times \left[ \sum_i (CMM_{PJi,y} - CMM_{BLi,y}) + \sum_i (PMM_{PJi,y} - PMM_{BLi,y}) \right] \quad (8)$$

Where:

$CMM_{BLi,y}$  is pre-mining CMM from underground boreholes that would have been captured, sent to and destroyed by use  $i$  in the baseline scenario in year  $y$  ( $tCH_4$ )

$PMM_{BLi,y}$  is the post-mining CMM from surface goaf wells that would have been captured, sent to and destroyed by use  $i$  in the baseline scenario in year  $y$  ( $tCH_4$ )

$CMM_{Pji,y}$  is pre-mining CMM from underground boreholes that would have been captured, sent to and destroyed by use  $i$  in the project activity in year  $y$  ( $tCH_4$ )

$PMM_{Pji,y}$  is post-mining CMM from surface goaf wells that would have been captured, sent to and destroyed by use  $i$  in the project activity scenario in year  $y$  ( $tCH_4$ )

As described in the PDD, city gas utilization in coal-mine workers' residences in Tiefa coal-field will take place in both the baseline scenario and the project scenario as a business as usual activity, thus, is not affected by the project activity, and does not influence the emission reductions. These quantities of gas delivered to the miners' residences are separate from the other gas demand, and the monitored gas supply,  $MM_{GAS}$ , excludes the supply to the miners. Therefore, emissions in both the baseline and project scenario from the gas supply to the miners is considered zero; thus the methane destruction in baseline scenario is considered  $BE_{MD,y}$  is 0.

As described in the PDD, leakage is zero.

## 2.5 Project Timeline

|                                 |                 |
|---------------------------------|-----------------|
| CDM registration Data           | 6 December 2008 |
| Start of this monitoring period | 1 April 2006    |
| End of this monitoring period   | 5 December 2008 |

## 3 Monitoring Plan

### 3.1 Roles and responsibilities

The Project Developer has designated Mr. Liu Hongwei as the Monitoring Manager for the CDM project, heading the monitoring team in order to enforce monitoring, data recording and storage according to the monitoring plan indicated in the PDD.

### **3.2 Training**

The operator provided training at the start of the project to its technicians to enable them to undertake the tasks required by this monitoring plan. Training was also provided for all new equipment installed by the equipment providers. China Coal Information Institute, Mitsui & Co Ltd and Carbon Resource Management Ltd advised the project developer on CDM, monitoring and operational work.

### **3.3 Data Collection / Monitoring Equipment**

Tiefen Coal Industrial Group (TCIG) collects and records the data from the two gas supply companies. TCIG cross-checks the collected data with the data from its own monitoring system, and addresses any anomalies as specified in the PDD before being filed for future reference. No anomalies were found. All data is kept at least until two years after the end of the project crediting period.

### **3.4 Quality Assurance**

All monitoring equipment is maintained and calibrated as per the manufacturer's requirements.

## **4 Monitoring Results**

### **4.1 Data Requirement**

The data to be monitored and needed for the calculation of project and baseline emissions are listed in the table below.

As the gas extraction systems are combined, pre- and post-mining CMM that is captured and destroyed in project by utilisation through the gas grid is monitored together.

**Table 1 Main data required**

| Factor                | Unit             | Description                                                       |
|-----------------------|------------------|-------------------------------------------------------------------|
| $MM_{GAS}$            | tCH <sub>4</sub> | Methane supplied to gas grid                                      |
| $CONS_{ELECT, PJ, t}$ | MWh              | Additional electricity consumption for capture and use of methane |

Additional data to be monitored for the project are:

**Table 2 Additional data required**

|             |   |                                                                                                                      |
|-------------|---|----------------------------------------------------------------------------------------------------------------------|
| $PC_{CH_4}$ | % | Concentration (in volume) of methane in extracted gass on wet basis, which is required to calculate $MM_{GAS}$ above |
| $PC_{NMHC}$ | % | NMHC concentration (in volume) in extracted gas; Gas sample will be analyzed once a year at a qualified institute.   |

## 4.2 Data from the PDD

The fixed values used to calculate emission reduction from the PDD are given in Table 3 below.

**Table 3 Fixed values**

| Factor       | Value  | Description                                                                                                       |
|--------------|--------|-------------------------------------------------------------------------------------------------------------------|
| $CEF_{ELEC}$ | 1.0518 | Grid emissions factor calculated using ACM0002, and fixed for the first crediting period (tCO <sub>2</sub> e/MWh) |
| $CEF_{CH_4}$ | 2.75   | CO <sub>2</sub> emission for combusted methane (tCO <sub>2</sub> e/tCH <sub>4</sub> )                             |
| $Eff_{GAS}$  | 98.5   | Efficiency of methane destruction/oxidation through gas grid to various combustion end users (%)                  |
| $GWP_{CH_4}$ | 21     | Global warming potential of methane                                                                               |

|                            |      |                                                                                                         |
|----------------------------|------|---------------------------------------------------------------------------------------------------------|
|                            |      | (tCO <sub>2</sub> e / tCH <sub>4</sub> )                                                                |
| Density of CH <sub>4</sub> | 0.67 | Density of methane at normal temperature and pressure <sup>2</sup> (kgCH <sub>4</sub> /m <sup>3</sup> ) |

### 4.3 Monitored Data

The CMM gas from Daxing and Daming coal mines has been collected and supplied to the gas grid since January 2007 and July 2007, respectively. All the other coal mines collected the gas since before 2006. The amount of CMM gas and additional electricity consumption are shown in the tables 4 and 5 below.

**Table 4 Gas flow to the gas supply grid**

| Period*      | Tieling City<br>(‘000 m3 CH4) | FeBe Factory<br>(‘000 m3 CH4) | Faku Ceramic City<br>(‘000 m3 CH4) | Diaobingshan City<br>(‘000 m3 CH4) | MM_GAS<br>(tCH4) |
|--------------|-------------------------------|-------------------------------|------------------------------------|------------------------------------|------------------|
| Apr-Dec 2006 |                               | 21,705                        |                                    | 20,443                             | 11,578           |
| Jan-Dec 2007 |                               | 44,786                        |                                    | 30,625                             | 20,715           |
| Jan-Dec 2008 |                               | 47,908                        |                                    | 31,211                             | 21,734           |
| Total        |                               | 114,400                       |                                    | 82,279                             | 54,028           |

*Note: Starting 1 April 2006, and finishing 05 December 2008.*

**Table 5 Additional electricity consumption by the project  
2006**

|            | Shihuangdi North<br>(MWh) | Shihuangdi<br>24# (MWh) | Shihuangdi 25#<br>(MWh) | Hongfang (MWh) | Xiaoqing<br>(MWh) | Zhangzhuang<br>60# (MWh) | Zhangzhuang<br>Compressor<br>(MWh) | Total (MWh) |
|------------|---------------------------|-------------------------|-------------------------|----------------|-------------------|--------------------------|------------------------------------|-------------|
| Apr. 2006  | 67.36                     | 135.12                  | 165.12                  | 0.96           | 53.16             | 20.08                    | 18.9                               | 460.7       |
| May. 2006  | 92.64                     | 219.36                  | 19.44                   | 0              | 34.2              | 15.52                    | 15.3                               | 396.46      |
| Jun. 2006  | 34.68                     | 73.44                   | 30.96                   | 0              | 3.84              | 19.52                    | 75.6                               | 238.04      |
| July. 2006 | 54.6                      | 133.2                   | 0                       | 0.86           | 13.68             | 16.48                    | 1.8                                | 220.62      |
| Aug. 2006  | 41.92                     | 115.68                  | 64.8                    | 0              | 23.88             | 17.04                    | 32.4                               | 295.72      |
| Sep. 2006  | 5.28                      | 214.56                  | 58.8                    | 0              | 22.56             | 11.44                    | 122.4                              | 435.04      |
| Oct. 2006  | 5.4                       | 128.4                   | 265.2                   | 0              | 36.24             | 5.2                      | 126.9                              | 567.34      |
| Nov. 2006  | 17.88                     | 299.28                  | 96.48                   | 0              | 51.6              | 19.84                    | 131.4                              | 616.48      |
| Dec. 2006  | 1.68                      | 83.52                   | 31.44                   | 5.44           | 73.2              | 9.6                      | 110.7                              | 315.58      |
| Total      | 321.44                    | 1402.56                 | 732.24                  | 7.26           | 312.36            | 134.72                   | 635.4                              | 3545.98     |

<sup>2</sup> 20°C and 1 atm.

**2007**

|            | Shihuangdi (MWh) | Daxing (MWh) | Xiaoqing (MWh) | Zhangzhuang (MWh) | Daming (MWh) | Hongfang (MWh) | Total (MWh) |
|------------|------------------|--------------|----------------|-------------------|--------------|----------------|-------------|
| Jan.2007   | 199.8            | 134.64       | 63             | 18.02             | 0            | 4.64           | 420.1       |
| Feb. 2007  | 82.56            | 181.704      | 25.8           | 35.34             | 0            | 4.44           | 329.844     |
| Mar. 2007  | 151.92           | 146.952      | 13.2           | 8.18              | 0            | 3.06           | 323.312     |
| Apr. 2007  | 95.28            | 188.664      | 18.48          | 13.78             | 0            | 0.88           | 317.084     |
| May. 2007  | 85.08            | 182.04       | 36.48          | 137.8             | 0            | 0              | 441.4       |
| Jun. 2007  | 345.12           | 241.536      | 67.2           | 112.44            | 0            | 0              | 766.296     |
| July. 2007 | 268.92           | 236.472      | 58.8           | 87.34             | 14           | 0              | 665.532     |
| Aug. 2007  | 410.04           | 249.168      | 96.24          | 69.1              | 61.2         | 0              | 885.748     |
| Sep. 2007  | 429.36           | 183.072      | 89.16          | 132.64            | 49.6         | 0              | 883.832     |
| Oct. 2007  | 307.92           | 155.04       | 73.2           | 202.74            | 19.2         | 0              | 758.1       |
| Nov. 2007  | 322.56           | 117.768      | 83.4           | 213.34            | 125.196      | 0              | 862.264     |
| Dec. 2007  | 362.76           | 128.736      | 73.2           | 158.5             | 7.3          | 3.62           | 734.116     |
| Total      | 3061.32          | 2145.792     | 698.16         | 1189.22           | 276.496      | 16.64          | 7387.628    |

**2008**

|            | Shihuangdi (MWh) | Daxing (MWh) | Xiaoqing (MWh) | Zhangzhuang (MWh) | Daming (MWh) | Hongfang (MWh) | Total (MWh) |
|------------|------------------|--------------|----------------|-------------------|--------------|----------------|-------------|
| Jan.2008   | 195.36           | 205.128      | 83.76          | 95.4              | 5.5          | 3.4            | 588.548     |
| Feb. 2008  | 39.12            | 191.112      | 76.8           | 68.64             | 9.6          | 3.06           | 388.332     |
| Mar. 2008  | 188.76           | 201.408      | 48.48          | 100.62            | 3.6          | 2.1            | 544.968     |
| Apr. 2008  | 358.92           | 269.688      | 97.2           | 269.1             | 4.9          | 0              | 999.808     |
| May. 2008  | 383.88           | 278.544      | 0              | 179.42            | 2.7          | 0              | 844.544     |
| Jun. 2008  | 339.24           | 305.232      | 83.4           | 172.72            | 4.4          | 0.02           | 905.012     |
| July. 2008 | 306.36           | 279.456      | 57.96          | 134.22            | 38.7         | 0              | 816.696     |
| Aug. 2008  | 141.36           | 262.824      | 60.48          | 179.12            | 48.2         | 0              | 691.984     |
| Sep. 2008  | 43.68            | 232.872      | 58.56          | 196.48            | 69.26        | 0              | 600.852     |
| Oct. 2008  | 58.7124          | 281.448      | 51.6336        | 147.4             | 66.4444      | 0              | 605.6384    |
| Nov. 2008  | 106.5892         | 272.292      | 54.96          | 39.7              | 38.481       | 2.473          | 514.4952    |
| Dec. 2008  | 7.912            | 112.574      | 17.64          | 3.56              | 9.551        | 0.923          | 152.16      |
| Total      | 2169.8936        | 2892.578     | 690.8736       | 1586.38           | 301.3364     | 11.976         | 7653.0376   |

*Note: Starting 1 April 2006, and finishing 05 December 2008.*

**4.4 Additional Data**

- Methane concentrations were required to calculate the methane quantities presented above. The concentration data has been presented to the DOE. The minimum methane concentration over the period was 41%, which is conservatively adopted for the whole period for the purpose of the calculation of emission reductions.
- NMHC concentrations have been below 1% during the monitoring period, and following the methodology can be ignored for the emission reduction calculations.

**5 Emission Reduction Calculations****5.1 Project Emissions**

From the data presented and using the formulae of section 2, project emissions can be calculated.

**Table 6 Project emissions for the project**

| Month        | PE_ME<br>(tCO <sub>2</sub> e) | PE_UM<br>(tCO <sub>2</sub> e) | PE_MD<br>(tCO <sub>2</sub> e) | PE<br>(tCO <sub>2</sub> e) |
|--------------|-------------------------------|-------------------------------|-------------------------------|----------------------------|
| Apr-Dec 06   | 3,730                         | 3,647                         | 31,362                        | 38,739                     |
| Jan-Dec 07   | 7,770                         | 6,525                         | 56,113                        | 70,409                     |
| Jan-Dec 07   | 8,049                         | 6,846                         | 58,872                        | 73,768                     |
| <b>Total</b> | <b>19,549</b>                 | <b>17,019</b>                 | <b>146,347</b>                | <b>182,916</b>             |

*Note: Starting 1 April 2006, and finishing 05 December 2008.*

## 5.2 Baseline Emissions

**Table 7 Baseline emissions for the project**

| Month        | BE_Use<br>(tCO <sub>2</sub> e) | BE_MD<br>(tCO <sub>2</sub> e) | BE_MR<br>(tCO <sub>2</sub> e) | BE<br>(tCO <sub>2</sub> e) |
|--------------|--------------------------------|-------------------------------|-------------------------------|----------------------------|
| Apr-Dec 06   | -                              | -                             | 243,139                       | 243,139                    |
| Jan-Dec 07   | -                              | -                             | 435,024                       | 435,024                    |
| Jan-Dec 08   | -                              | -                             | 456,415                       | 456,415                    |
| <b>Total</b> | <b>-</b>                       | <b>-</b>                      | <b>1,134,579</b>              | <b>1,134,578</b>           |

*Note: Starting 1 April 2006, and finishing 05 December 2008.*

## 5.3 Leakage Emissions

As described in the PDD, leakage from the project are considered zero.

## 5.4 Emission Reductions

**Table 8 Emission reduction calculation for the project**

| Month        | BE<br>(tCO <sub>2</sub> e) | PE<br>(tCO <sub>2</sub> e) | Leakage<br>(tCO <sub>2</sub> e) | Reductions<br>(tCO <sub>2</sub> e) |
|--------------|----------------------------|----------------------------|---------------------------------|------------------------------------|
| Apr-Dec 06   | 243,139                    | 38,739                     | 0                               | 204,400                            |
| Jan-Dec 07   | 435,024                    | 70,409                     | 0                               | 364,615                            |
| Jan-Dec 08   | 456,415                    | 73,768                     | 0                               | 382,647                            |
| <b>Total</b> | <b>1,134,578</b>           | <b>182,916</b>             | <b>0</b>                        | <b>951,662</b>                     |

*Note: Starting 1 April 2006, and finishing 05 December 2008.*

## 6 Conclusion

This monitoring report is summarized below:

The Reporting period: From 01-04-2006 to 05-12-2008

Monitored emission in the above reporting period:

|                     |           |                   |
|---------------------|-----------|-------------------|
| Project emissions   | 182,916   | t CO2 equivalents |
| Baseline emissions  | 1,134,578 | t CO2 equivalents |
| Emission reductions | 951,662   | t CO2 equivalents |